COMPREHENSIVE REGIONAL ASSESSMENT

East Gippsland

Environment and Heritage Report

This report has been prepared to support the Regional Forest Assessment process.

Comprehensive Regional Assessment

East Gippsland

Environment and Heritage Report

July 1996

Prepared by officials to support the East Gippsland Regional Forest Agreement Process

This report is one of eight reports. The other reports are:
Overview of Assessments
Resource and Economics Report
Social Report
National Estate Report
Wilderness of the Eastern Victorian Forests
Methods Paper: East Gippsland National Estate Assessment
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APPENDIX G - ECOLOGICAL VEGETATION CLASSES METHODOLOGY PAPER

Ecological vegetation classes: The practical intersection of a vegetation classification and planning for biodiversity conservation and ecological management

Introduction

Planning for biodiversity conservation and subsequent ecological management is most appropriately conducted within an information framework based on the concepts of ecosystem and habitat. In relation to this notion, Graetz and Wilson (1994) advance the following pragmatic argument:

" Ecosystems and habitats are both abstractions but they are central to contemporary ecological theory and critical to conservation management. Ecosystems only exist when they are defined. They may range in size from a rotting leaf to an island continent. Similarly, the powerful concept of habitat is only useful when it is defined by reference to the life history attributes of a species of interest. Though both of these concepts are powerful in organising our ecological understanding, they can only become useful when they are tangible. This critical step is achieved by relating both ecosystems and habitat to landcover. Landcover is defined as the cover of vegetation, water or snow, and including the soil layer, within a topographic context. Landcover with the addition of fauna becomes the terrestrial biosphere."

Vegetation, the component of landcover which is both sedentary and living, in particular represents the integration of the ecosystem and its history at each site (Kirkpatrick and Dickinson 1986).

Stands of native vegetation, and the ecosystems of which they are the most tangible part, are complex and dynamic entities. Ecologists recognise that such vegetation is most accurately studied when treated as a multi-dimensional, continuously variable entity, and for quantitative interpretation this requires sophisticated experimental design, analysis and presentation. However, for the purpose of helping non-specialists to better understand this complexity and to make the pragmatic decisions that are inherent in planning for biodiversity conservation and vegetation management, it is useful to classify the variation into an informative and accessible framework. This report outlines the approach to vegetation classification in the Department of Natural Resources and Environment (DNRE) in Victoria, in particular noting its practical strengths and options for on-going improvement.

For well over a decade, a vegetation classification system based on primary floristic data (i.e. direct field collection of site-based plant species occurrences) has been used by most survey botanists in this State, primarily led by those working in DNRE (and its predecessors). This was initially based on the Zurich-Montpellier approach (Mueller-Dombois and Ellenberg 1974; Bridgewater 1981).

The use of floristic data was developed in preference to the more established approach of structural and/or dominant species classification for two important reasons:

1. distribution information on individual species (from all strata) as well as on vegetation types was required for effective conservation planning at all levels, and primary floristic data could provide for and integrate these requirements; and
2. primary floristic data is highly information-rich, since the occurrence of each species can be linked to site characteristics and site history, and may also relate to co-occuring fauna.

This classificatory approach consequently led to the development of a two-tiered floristic typology: floristic sub-communities, which were the primary products of computer-based analyses, and were the focus for the detailed description of native vegetation in each study area; and floristic communities, which were a combination of similar sub-communities, and were the focus for descriptive summaries and for vegetation mapping.

Around the time that broad-scale old-growth survey was being pioneered in East Gippsland (Woodgate *et al.* 1994), the floristic typology was being adapted because of:

1. the need to combine the results of regional and local studies into an integrated statewide framework, which required the interpretation of apparent inconsistencies in the application of community names that can arise when a purely floristic classification is used over a very large area. This occurs because floristic composition responds to both local environmental variations and changes along broad biogeographic gradients (e.g. on purely floristic grounds a Cool Temperate Rainforest community in East Gippsland may be more different from a Cool Temperate Rainforest community in the Otways than it is from its' adjacent Wet Forest community in East Gippsland);
2. the need for a vegetation classification which could efficiently allow both assessment of representation at the landscape level, as well as support the modelling of naturalness at the landscape scale as part of the old growth assessment methodology. This methodology combines vegetation mapping and disturbance history mapping according to rules based on the inferred responses of vegetation types to different disturbances;
3. the need to summarise (but not overly simplify) the diversity of vegetation communities for presentation at the Statewide level; and
4. the desirability of making information on vegetation types more accessible to land managers and the broader community (e.g. the development of user-friendly common names).

These considerations stimulated the development of a third level in the typology, which have been called ecological vegetation classes (EVCs).

The key feature of this third level is that, although it builds directly from the floristic communities of the second level, a new set of attributes are used both for aggregating floristic communities into ecological vegetation classes and for discriminating between one ecological vegetation class and another.

In essence, at the floristic composition level, this means shifting the focus from the number of species which are in common, to the type (in a life strategy rather than a taxonomic sense) of species which are in common for the floristic communities which constitute the ecological vegetation class. Using only floristic similarity information above the second level of the hierarchy is a less discriminating approach from an ecological perspective, because relatively ubiquitous, generalist species start to dominate the classification.

Definitions

Floristic sub-community
A floristic sub-community comprises vegetation from a range of sites which share a high (subjectively-chosen) level of floristic similarity. These aggregations of quadrats may relate to different temporal phases of floristic communities (such as seral stages following fire), or the differences arising from a transient annual flora or, can be mediated by microclimatic variations below the landscape scale which are related to position on the slope or proximity to another floristic community.

Floristic community
A floristic community is an aggregation of floristic sub-communities which share a common core of species, but with a lower (subjectively-chosen) level of floristic homogeneity than a floristic sub-community. A floristic community is typically considered to reflect the vegetation's response to perennial environmental and/or biogeographic factors at the landscape scale. These influences include variations in geology, soils, minor altitudinal changes, landform and aspect. Table 1 illustrates the floristic differences between two floristic communities of the ecological vegetation class Lowland Forest in East Gippsland.

Ecological vegetation class
An ecological vegetation class consists of one or a number of floristic communities that appear to be associated with a recognisable environmental niche, and which can be characterised by a number of their adaptive responses to ecological processes that operate at the landscape scale. Each ecological vegetation class is described through a combination of its floristic, life-form and reproductive strategy profiles, and through an inferred fidelity to particular environmental attributes.

The term ecological vegetation class was chosen for the following reasons:

- ecological - to reflect the focus on likely ecological behaviour, and to differentiate from a primarily structural or floristic focus;

- vegetation - self-evident, but needs to be included to acknowledge that only the measured occurrences and inferred ecological responses of plants are being routinely considered; and
- class - a neutral collective noun which does not have the attached history of terms like community, alliance, association or ecotype.

Landscape Scale

An area which may range from, at a minimum, the combination of four adjacent topographical features (e.g. ridge, exposed slope, drainage line, protected slope), through to the aggregation of a repeated pattern of such combinations (the latter being comparable to a land system as described in LCC (1988)).

Table 1. Two-way table of some Lowland Forest quadrats in East Gippsland

		EEEEEEEEEEEEEEEEEEE GGGGGGGGGGGGGGGGGGG 1111111111111111111 CCOCCCFFOOOOOOOOOOOC 1131111113333333331 3357775557777557773 0000000000160016660 3417780745527470557 2 1260103453478207792 0	EEEEE GGGGG 22222 OOOOO 33333 77777 88888 14411 57812	
2463	Persoonia juniperina	1+1 +		Prickly Geebung
2938	Ricinocarpos pinifolius	1141 1 + 2		Wedding Bush
3592	Xanthosia pilosa	1111+1+ 1 + 1		Woolly Xanthosia
95	Acacia terminalis	2231+121122 1 1	2	Sunshine Wattle
206	Amperea xiphoclada var. xiphoclada	1111 1+1111+1 1 +	1	Broom Spurge
237	Aotus ericoides	2122 1+ + 1		Common Aotus
366	Banksia serrata	1222 21121212		Saw Banksia
63	Acacia myrtifolia	++1 ++++1+ +1		Myrtle Wattle
2436	Patersonia glabrata	111 +1+ 11 211 111+	1	Leafy Purple-flag
3348	Tetrarrhena juncea	11+12122211121322+2	+	Forest Wire-grass
1667	Hibbertia empetrifolia	1+++1+1+111211311 1		Tangled Guinea-flower
832	Correa reflexa	1+11 ++ 11+ + 1		Common Correa
958	Dampiera stricta	11+1+111111111+1+111		Blue Dampiera
403	Billardiera scandens	++++ 1+++1 +1+1++ 1	11+	Common Apple-berry
1027	Dianella caerulea var. caerulea	1111+1+ + +1 1+ 1	+++++	Paroo Lily
1165	Epacris impressa	11+1 +11+1111++1212	11++	Common Heath
1490	Gonocarpus teucrioides	1111131111 +11121121	+11	Germander Raspwort
2568	Platylobium formosum	222 + 23121+23 31222	+++	Handsome Flat-pea
2777	Pteridium esculentum	323 221 211+11 21+12	223 +	Austral Bracken
1281	Eucalyptus globoidea	13 2+2++2 +3 43231	22133	White Stringybark
3353	Tetratheca pilosa	1111 1++111111 3+1 1	+1+	Hairy Pink-bells
3023	Scaevola ramosissima	1+ +1 +++1 1+++1	+++	Hairy Fan-flower
1923	Lepidosperma laterale	1 1 ++++1 11+1++21	+1+	Variable Sword-sedge
1161	Entolasia marginata	+ 11 + 1 2 +1	+111	Bordered Panic
2465	Persoonia linearis	++++1+ +11 1+++1	+++ +	Narrow-leaf Geebung
3528	Viola hederacea	+++11 1 11+++	111 1	Ivy-leaf Violet
3594	Xanthosia tridentata	+ ++++21+ ++2	++ +	Hill Xanthosia
2523	Pimelea humilis	++ 1 1+ + +1	111+1	Common Rice-flower
512	Burchardia umbellata	+ ++ +11 ++	1+ 11	Milkmaids
3689	Drosera peltata	+ ++1 +1 +	+++1	Tall Sundew
367	Banksia spinulosa var. cunninghamii	+ +2 2 21+1 ++		Hairpin Banksia
440	Bossiaea prostrata	+ +1 2+	+1++	Creeping Bossiaea
2042	Lomandra filiformis	+1+ ++	+ 1	Wattle Mat-rush
3400	Thysanotus tuberosus	+++ +	+ +	Common Fringe-lily
999	Daviesia ulicifolia	+ 1 + 1++		Gorse Bitter-pea
123	Acrotriche serrulata	+ + + 11	+11++	Honey-pots
3588	Xanthorrhoea minor ssp. lutea	1 1 +1+1	2++13	Small Grass-tree
5058	Viola hederacea ssp. hederacea	1 1 +	111 1	Ivy-leaf Violet
2014	Lindsaea linearis	+ +1+ +	+++1	Screw Fern
304	Astroloma humifusum	+	+++ 1	Cranberry Heath
1394	Gahnia radula	1 1	21111	Thatch Saw-sedge
1626	Helichrysum scorpioides	++ + + 1	++ +1	Button Everlasting
1662	Hibbertia aspera	+	+22+2	Rough Guinea-flower
1723	Hydrocotyle laxiflora		111 1	Stinking Pennywort
1741	Hypericum gramineum	1 1	++111	Small St John's Wort
1748	*Hypochoeris radicata	+ +	++12	Cat's Ear
1861	Lagenifera gracilis	+ +	++ +1	Slender Lagenifera
2179	Microlaena stipoides var. stipoides	+ +	11+1	Weeping Grass
3039	Schoenus apogon	1 + +	+++++	Common Bog-sedge
3387	Themeda triandra	2	++ 2+	Kangaroo Grass

Description of Methods
Methods for vegetation survey, classification and mapping have evolved since the earliest work was done in East Gippsland (Forbes *et al.* 1981). The following descriptions of methods are annotated according to whether they represent past practice, current practice or potential improvements. The potential improvements include approaches which would be preferred because they are more sophisticated and scientifically rigorous, but may not be feasible within limitations of time and resources.

Sampling strategy and data sources
Data may be obtained from a range of sources, including localised environmental impact assessments, investigations of geographically restricted species or vegetation types, ecosystems studies (such as grasslands or rainforests), or regional studies for land use or land management purposes.

The catalyst for the investigation of ecological vegetation class-floristic community relationships is generally a regional or ecosystem study. This is the preferred approach since it can provide a more comprehensive perspective and allows for a more consistent sampling strategy to be applied. Where there is a need to use data from several studies, which were conducted using different rules and/or sampling intensities, the approach to subsampling and combining data is determined on a case-by-case basis with a view to reducing the inherent problems of analysis and interpretation.

Past practice is outlined by Forbes *et al.* (1981) as follows: the "*study area was divided into rectangles of dimensions 5 minutes latitude and 5 minutes longitude. Within each rectangle substantially covered by native vegetation four sample sites were chosen (occasionally more in the varied vegetation near the coast and occasionally less in rectangles that were poorly vegetated) so that they differed as much as possible in gross habitat features (ridgetop, river, swamp, hillside, etc.).*"

In their study 590 quadrats were located in this way in East Gippsland. In the subsequent decade many more quadrats were collected in a series of local area studies (prelogging surveys of Forest Management Blocks) in which sampling intensities were an order of magnitude higher than the original regional study.
Current practice is to manually stratify the study area using available mapping of the following attributes (the typical level of discrimination within each attribute is also indicated):

- geology: sedimentary (sandstones/conglomerates, siltstones/mudstones, limestones/marls), aeolian (siliceous, gypseous, calcareous), igneous (granite, adamellite, granodiorite, tonolite, basalt, dacite, ignimbrite), metamorphic (hornfels, schist, gneiss, marble), alluvial (boulders, cobbles, gravels, sands, silts, clays, etc.);
- geomorphic unit (coast, lake, plain, dissected hills, plateau, alpine peak, etc.);

- landform (beach, dune, tidal flat, ridge, slope, alluvial flat, alluvial terrace), landsystem etc.;
- major elevation units (<100m, 101-500m, 501-900m, 901-1200m and >1200m)
- aspect and topography; and
- structural vegetation mapping (generally forest types).

The obvious potential improvement is to stratify using digital coverages, and this is done where the key datasets are available in this form and when resources allow.

A predetermined sampling intensity is applied to this stratification on a map tile by map tile basis to ensure a consistent geographic coverage. There is no statistical basis for the number of sites sampled but experience from a variety of studies using different sampling intensities (Ritman 1994) indicates that for regional studies (ie areas covering more than 3-4 1:100 000 map tiles) intensities of 30-100+ sites per 1:100 000 map sheet (the former is relatively homogenous semi-arid plains, the latter a complex temperate tablelands) provide a workable minimum for the definition of vegetation types that can be routinely observed by aerial photograph interpretation (API) at approximately this scale. A potential improvement would be to conduct some preliminary sampling of each strata in order to quantitatively determine the required sampling intensities for each study area.

In both past and current situations the approach to final placement of the sample site (quadrat) is that the most conveniently accessible example(s) of the stratified type are located in the field and the quadrat is placed within a visually assessed, apparently uniform stand. Current practice is to randomly place the quadrat within the core of the stand. This practice intentionally avoids ecotones between apparent vegetation types, which is appropriate where the primary goal is classification of the data, but also means that the data carry a bias which is not appropriate for some other analyses/modelling which could be performed. The obvious and often discussed potential improvement would be to increase the degree of randomisation but this must be traded-off against the associated increase in time and resources.

Analysis and interpretation
The following description of past practice for floristic analysis is largely derived from Mueck and Peacock (1992). Floristic data have mostly been classified using NEAR, a method outlined by Gullan (1978). Briefly, the NEAR analysis involves a polythetic, agglomerative, non-hierarchical clustering procedure (the normal analysis) followed by an editing procedure which removes species which are not indicative of any vegetation group from the data, before the inverse analysis.

The clustering procedure used is a modification of the procedure devised by Carlson (1972). The similarity matrix used by the Carlson clustering procedure is the Jaccard coefficient (Jaccard 1908 in Gullan 1978), which is a relatively simple expression of mathematical similarity.

The number of clusters generated is dependent on the heterogeneity of the data set with small groups (clusters), created by quadrats that are >60% similar and large groups created by quadrats that are >35% similar. Large groups are primarily used to assist preliminary sorting of small groups for presentation. The matrix uses only species presence/absence data; the cover-abundance data are not used in this analysis although they are displayed on the two-way table.

The results of the analysis are presented as a two-way table which arranges species and classified quadrats on the two axes and contains the cover-abundance data in the body of the table (example Table 1). A handsorting process may then be undertaken. Handsorting can include the subjective arrangement of quadrats within small groups, small groups with respect to each other and of species (which are not given a fixed order by the classification). The handsorting process is done in order to provide an effective visual display of the floristic gradients and relationships within the data.

Floristic sub-communities are based on small groups and are generally only used to describe variation in vegetation at the local level such as for forest blocks, (e.g. Humphries *et al.* (1991), or when data is scant at the regional scale (e.g. Forbes *et al.* (1981)).

Floristic communities are based on subjective aggregations of floristic sub-communities, with these judgements being based on a priori assumptions about which species are of particular importance in ecological functioning (so-called keystone species), the floristic gradient across physically adjacent subcommunities, and the level of discrimination that is useful for ecological management objectives. Floristic communities are used to describe vegetation at the sub-regional scale (Woodgate *et al.* (1994), in part (e.g. EVC 14 Banksia Woodland) or studies focused on one particular vegetation type (e.g. the Limestone Pomaderris Shrubland ecological vegetation class in Peel (1993)).

Current practice is increasingly to base the classification on PATN (Belbin 1988) which is more widely used within Australia. In some cases , the results of both NEAR and PATN analyses are compared. One of the advantages of PATN over NEAR is that it does not work to fixed heterogeneity levels but builds a dendrogram based on the variable levels within the data. However, translating the results of a PATN analysis to a typology suitable for vegetation type description and mapping still requires a subjective decision as to which level of the dendrogram will be used for this purpose.

Two-way tables are an effective way of displaying both relationships between floristic entities and the raw data which most characterise them, and will continue to be the preferred means of presenting a classification regardless of the analytical technique employed.

For specific conservation purposes there is sometimes a need to determine whether a floristic community can be delineated on the basis of a minimal dataset. For this situation the following guidelines have been set:

- there should be a minimum of five quadrats comprising the proposed floristic community (from different stands where this is feasible) and a similar sampling of adjacent non-target vegetation types in order to illustrate its distinctiveness from the surrounding vegetation; and
- five more quadrats which sample its apparently nearest floristic relative within the same natural region *sensu* Conn (1993) should also be presented which demonstrate these relationships.

The number of quadrats is arbitrary from a statistical viewpoint, but is based on experience from larger datasets. Where a vegetation type is extremely restricted, but otherwise apparently distinctive, as few as three quadrats have been presented to delineate a floristic community.

Ecological vegetation class characterisation

The ecological vegetation class concept focuses on selected non-taxonomic characteristics of floristic communities and on the floristic communities' inferred relationships with particular environmental parameters.

The type of non-taxonomic attributes routinely considered include:

- Life-forms: for example, tree (closed or open canopied), shrub, climber, graminoid, herb, perennial geophyte, annual, tree-fern, ground-fern, epiphytes (vascular and non-vascular).
- Reproductive strategy: for example, obligate seed regenerators, resprouters, animal dispersed).
- Structure: for example, forest type (species dominance and height), canopy height (>40m, 28-40m, 15-28m, 2-15m, <2m), canopy density (Specht's categories) and canopy closure.

Current practice is to construct profiles of these attributes for each floristic community, and to use these as part of the subjective judgement as to whether two or more floristic communities could be considered *a priori* to be part of the same ecological vegetation class. Potential improvements to this process which are being actively pursued include:

- increasing the level of discrimination for attributes (e.g. approximately 50 classes for life-form; collecting information of the type described by Noble and Slatyer (1980) as vital attributes);
- databasing the attribute information for the complete State species list so that automated preparation and analysis of profiles can be undertaken, and that the original floristic data can be analysed and presented from a non-taxonomic perspective where this is useful; and
- use of algorithms which explicitly quantify the variation of attributes within and between the profiles.

The type of physical environment attributes routinely considered include:

- aspect, elevation, gradient, geology (for example, age and type-limestone, sandstone, granodiorite etc. and composition);
- soils (for example, origin, clay content, depth, organic content and drainage characteristics, hard pans);
- landform;
- rainfall (for example, total rainfall, effective rainfall, seasonality of rainfall);
- water relations (for example, level and frequency of inundation, depth to water table);
- salinity (for example, saline, brackish, freshwater); and
- broad climatic zone (for example, maritime, continental, warm temperate, cool temperate, montane, sub-alpine).

Current practice is to construct profiles of these attributes, either from original site data or from maps, for the quadrats in each floristic community, and to use these profiles as part of the subjective judgement as to whether two or more floristic communities could be considered *a priori* to be part of the same ecological vegetation class. Potential improvements to this process include:

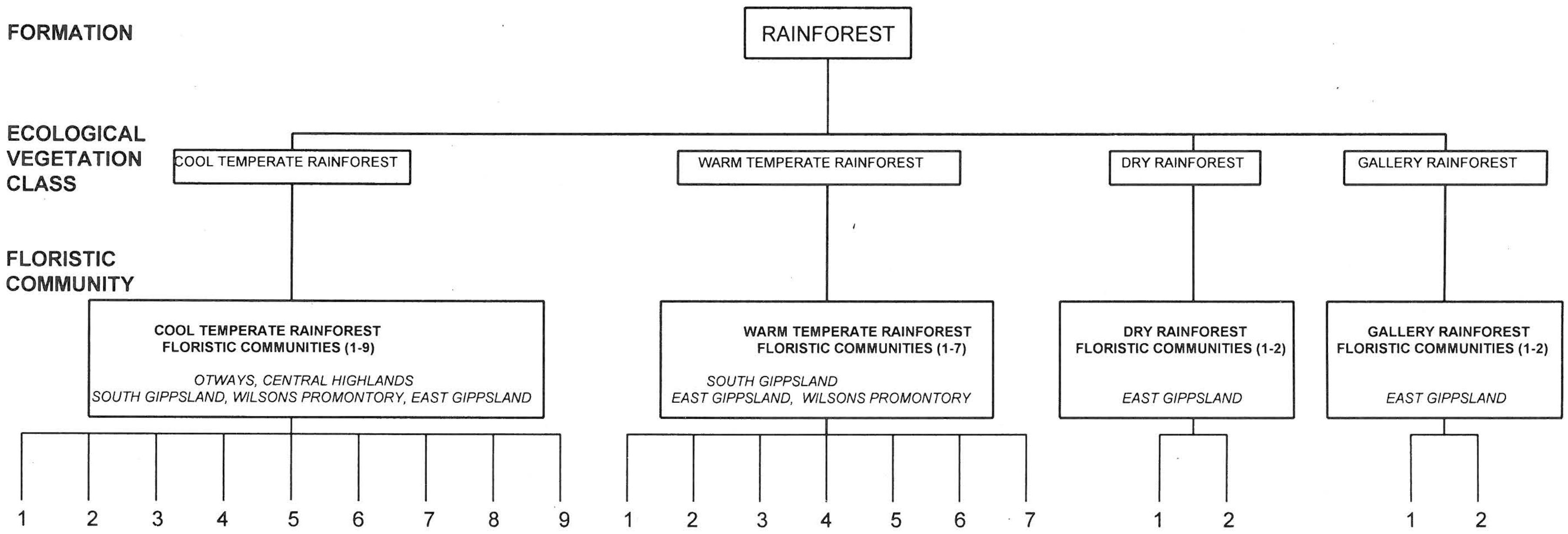
- gathering more detailed environmental data at quadrat sites, although this must be traded-off against the additional cost or the reduction in the number of quadrats which can be collected for the same cost;
- greater availability and usage of digitised coverages; and
- use of algorithms which explicitly quantify the variation of attributes within and between the profiles.

Where different floristic communities are considered by this process to be part of the same ecological vegetation class, the differences between them should be interpretable in terms of biogeographic gradients, isolation or endemism.
Where a floristic community is considered by this process to have no analog, it is by definition an ecological vegetation class in itself.

Any newly circumscribed floristic community or EVC is reviewed prior to inclusion into the Statewide Vegetation Typology (Attachment 1) which is being collated by the Flora and Fauna Branch, particularly in relation to EVCs that have already been described.

This process of defining floristic communities and aggregating them into EVCs has recently been conducted for the Rainforest Formation (DNRE (in prep)) and the result is summarised in Figure 1. Table 2 (located in the back pocket of this report) illustrates some floristic relationships within this formation, with a focus on Gallery Rainforest (DNRE (in prep)), a very restricted EVC which has only been recently recognised as occurring in Victoria. The neighbouring ecological vegetation classes are represented by the floristic communities Warm Temperate Rainforest (East Gippsland Alluvial Terraces) and Riparian Forest (East Gippsland). Two floristic communities of Gallery Rainforest have been identified. Only three quadrats are currently available for Gallery Rainforest (Ephemeral Streams).

Figure 1. Diagramatic illustration of the Victorian vegetation typology for the rainforest formation.



EVC: COOL TEMPERATE RAINFOREST
FLORISTIC COMMUNITY:

1 Cool Temperate Rainforest (Otways)
2 Cool Temperate Rainforest (Otways Redwater)
3 Cool Temperate Rainforest (Central Highlands)
4 Cool Temperate Rainforest (Central Highlands Montane Riparian)
5 Cool Temperate Rainforest (Central Highlands Montane Scrub)
6 Cool Temperate Rainforest (East Gippsland)
7 Cool Temperate Rainforest (East Gippsland Montane Riparian)
8 Cool Temperate Rainforest (East Gippsland Montane Scrub)
9 Cool Temperate Rainforest (Warm Temperate Rainforest Overlap, East Gippsland)

EVC: WARM TEMPERATE RAINFOREST
FLORISTIC COMMUNITY

1 Warm Temperate Rainforest (Cool Temperate Rainforest Overlap, Wilsons Promotory
2 Warm Temperate Rainforest (Cool Temperate Rainforest Overlap, East Gippsland)
3 Warm Temperate Rainforest (Cool Temperate Rainforest Overlap, Howe Range)
4 Warm Temperate Rainforest (Coastal East Gippsland)
5 Warm Temperate Rainforest (East Gippsland Alluvial Terraces)
6 Warm Temperate Rainforest (East Gippsland Foothills)
7 Warm Temperate Rainforest (Far East Gippsland)

EVC: DRY RAINFOREST
FLORISTIC COMMUNITY:

1 Dry Rainforest (Gorges)
2 Dry Rainforest (Limestone)

EVC: GALLERY RAINFOREST
FLORISTIC COMMUNITY:

1 Gallery Rainforest (Perennial Streams)
2 Gallery Rainforest (Ephemeral Streams)

NOTE: the dendrogram is illustrative only and does not represent the relative similarity of floristic communities

The delineation and characterisation of EVCs is clearly a pragmatic process, making use of whatever of the datasets described above are available and are considered a priori to be likely to reflect the ecological responses of the vegetation to the environmental attributes and the usual disturbance regime of its habitat. The attributes used for characterisation, and the relative influence they have on subjective judgements vary from one EVC to another.

The preferred attributes and their relative influence is illustrated in the following example: A floristic community with a range of species which normally regenerate in the absence of fire but can survive fire, may be a part of a rainforest EVC (Table 3). However, in itself, this is insufficient to characterise the vegetation as rainforest. Additional habitat requirements would include: soils with a relatively high organic content and a relatively fire-protected habitat. This would still not distinguish the vegetation from the EVC Wet Forest (Table 4). The presence of a closed canopy and the relative abundance of a range of life-forms such as ferns and epiphytes (Table 5) would distinguish the vegetation from Wet Forest. The interpretation of these biological and physical data sets in combination with the results of floristic analyses enable the ecological vegetation class to be identified as the EVC Cool Temperate Rainforest.

As a further example of the selection of attributes, Attachment 1 lists the physical attributes (and related features) used to support discrimination of EVCs in East Gippsland.

Nomenclature

Each EVC is given a common name that describes its key elements in order to convey a useful impression of the vegetation. Since one of the key purposes of classifying vegetation is to promote awareness and understanding by non-specialists, the following approach is used:

- names express the simplest, most readily understood concept of the class, in common language. Specialist jargon and Latin names, although they allow exacting and objective discrimination, are cumbersome and alienate people, and are avoided as much as possible;
- names generally avoid including a specific taxa, since this often creates the expectation that wherever the taxa occurs, the ecological vegetation class also occurs (and vice versa); and
- names routinely include broad environmental or structural descriptors which, although necessarily imprecise, better enable non-specialists to envisage the vegetation type.

Examples are provided in Attachment 1.

Table 3: Two-way table of some Cool Temperate Rainforest quadrats in Victoria.

	OOOOO	EEEEEEE	CCCCCCCCECCCC	
	TTTTT	HGGGGGG	HHHHHHHGHHHH	
VICTORIAN COOL TEMPERATE RAINFOREST				
IN FIVE NATURAL REGIONS	DDDDD	FCCFCCF	CCCFFOOCCFFO	
	00000	5460120	000150040550	
EAST GIPPSLAND (EG)	66666	3539609	000733370333	
CENTRAL HIGHLANDS, GIPPSLAND	11111	2820001	000122271222	
HIGHLANDS AND WILSONS PROMONTORY (CH)	77771	0511309	889001173001	
OTWAY RANGES (OT)	45676	4311797	784135629567	
Acacia melanoxylon	+++ 4	122		Blackwood
Asplenium flaccidum ssp. flaccidum	1111+			Weeping Spleenwort
Allantodia australis	+111			Austral Lady-fern
Coprosma quadrifida	11312	1		Prickly Currant-bush
Hymenophyllum cupressiforme	1111	+		Common Filmy Fern
Hymenophyllum rarum	+111			Narrow Filmy Fern
Lastreopsis acuminata	2133+			Shiny Shield-fern
Microsorum pustulatum	111 2	+		Kangaroo Fern
Olearia argophylla	2+ 2+		2	Musk Daisy-bush
Rumohra adiantiformis	11111			Leathery Shield-fern
Hedycarya angustifolia	2+221		+ +	Austral Mulberry
Hymenophyllum australe	1111+		1 +	Austral Filmy Fern
Polyphlebium venosum	+1111	++11	1 +	Veined Bristle-fern
Asplenium bulbiferum ssp. gracillimum	2112	1+1++	+	Mother Spleenwort
Hymenophyllum flabellatum	1111+	++11 ++		Shiny Filmy Fern
Clematis aristata	+1 +	+11+11	1	Mountain Clematis
Notelaea ligustrina	+1++	+113		Privet Mock-olive
Uncinia tenella	+111+	++ +++	1 + + +	Delicate Hook-sedge
Blechnum wattsii	13524	34 222	12224+12 21	Hard Water-fern
Grammitis billardieri	+1++	111111+	1111++1 +1	Common Finger-fern
Nothofagus cunninghamii	55454	4	2432323 +343	Myrtle Beech
Dicksonia antarctica	55555	1333333	23333331+11+	Soft Tree-fern
Polystichum proliferum	1211+	321 332	3324332+2434	Mother Shield-fern
Australina pusilla ssp. muelleri	+1	1+1 1 1	12 +12+ +11+	Shade Nettle
Pittosporum bicolor	+1 1+	+++1+	1 ++ ++	Banyalla
Histiopteris incisa		+ 1+11	2 121++ 21+	Bat's Wing Fern
Atherosperma moschatum		3443333	+2+1+15	Southern Sassafras
Blechnum fluviatile	+	1 1+	1 1 1 + +	Ray Water-fern
Elaeocarpus holopetalus		323223	2	Black Oliveberry
Telopea oreades		11121+		Gippsland Waratah
Viola hederacea		+ ++ +	1 2	Ivy-leaf Violet
Tasmannia lanceolata		+ +22+	+++	Mountain Pepper
Leucopogon maccraei		+++		Subalpine Beard-heath
Stellaria flaccida		11+	+ 1 +	Forest Starwort
Eucalyptus denticulata		11	2	Errinundra Shining Gum
Acacia dealbata		1 3	2	Silver Wattle
Carex appressa	+1 +			Tall Sedge
Libertia pulchella		+	1	Pretty Grass-flag
Persoonia silvatica		2		Forest Geebung
Eucalyptus regnans		+	2+1++	Mountain Ash
Acaena novae-zelandiae		+	+ + 2+ 1	Bidgee-widgee
Dianella tasmanica		+	1 + 21 1	Tasman Flax-lily
Eucalyptus delegatensis ssp. delegate			+ 3121	Alpine Ash
Hydrocotyle algida			1++	Mountain Pennywort
Olearia phlogopappa		+	2 1+ 1 1212	Dusty Daisy-bush
Senecio linearifolius			1 21++	Fireweed Groundsel
Uncinia flaccida			++++	Weak Hook-sedge
r Uncinia sp. aff. rupestris		11+		River Hook-sedge

Table 4: Two-way table of some Wet Forest quadrats in Victoria.

	EEEEEEEEEEEEEE GGGGGGGGGGGGGG	CCCCCECCCCCCCCCCC HHHHHGHHHHHHHHHHH	OOOOOOOOOOOOOOOOOOOO TTTTTTTTTTTTTTTTTTTT	
VICTORIAN WET FOREST **IN THREE BIOGEOGRAPHIC REGIONS:** **EAST GIPPSLAND** **CENTRAL HIGHLANDS** **OTWAY RANGES**	CCCCCCCCCCCCCC 66114444444444 33667777777777 33007777888788 22247118211812 27833144112190	CCCCCCFFFFFFFFOOO 00000601444444333 00000327999999666 01111300111111234 54568180111122150 79320063678901971	AAAAAMAAAAAAAAAAAAA 0011110000000000000 2277762222222228222 0000010000000000000 3503340346666674336 1265817661235671589O	
Notelaea venosa	++ +			Large Mock-olive
Coprosma hirtella	+1+ 1 1	+	+	Rough Coprosma
Fieldia australis	1++++ 1 12			Fieldia
Tylophora barbata	1+112			Bearded Tylophora
Eucalyptus cypellocarpa	12 1131 22	3 +	131 1	Mountain Grey Gum
Bedfordia arborescens	121233	1 1 + 3 1	+221+ 21	Blanket-leaf
Hydrocotyle geraniifolia	1++1++1 1	1 ++		Forest Pennywort
Elaeocarpus holopetalus	++ +21+			Black Oliveberry
Gahnia sieberiana	1 112 1 1		+	Red-fruit Saw-sedge
Prostanthera lasianthos	1 1 +1+11 2	1 2 + + 2	1 + + +	Victorian Christmas-bush
Eucalyptus denticulata	11+ 1 1 122			Errinundra Shining Gum
Oxylobium arborescens	1 2+ + 2			Tall Oxylobium
Parsonsia brownii	+ + +113+ 22	1 +		Twining Silkpod
Persoonia silvatica	12 121 222			Forest Geebung
Dianella tasmanica	+11+ +121 11	1++ ++	+ + + + 1	Tasman Flax-lily
Eucalyptus fastigata	421 3 2311423			Cut-tail
Telopea oreades	11111111223 22	+		Gippsland Waratah
Smilax australis	11123111+33 +			Austral Sarsaparilla
Acacia frigescens	24 +14244 3344	4 2		Frosted Wattle
Eucalyptus obliqua	3313314333133		13 1+2332+23233323	Messmate
Stellaria flaccida	+11 1 +2	1 1 2+ +1 1	1 + +++ +	Forest Starwort
Olearia argophylla	1+11+312 1232	211 1+ 2 1	211223+232 + + 21+	Musk Daisy-bush
Tetrarrhena juncea	12121111123+11	1312122+++ 111+11	3323112 24432323122+	Forest Wire-grass
Pteridium esculentum	1++ 121122 1	1 11 +++++1+1+21	+ 1 1121 1223++1	Austral Bracken
Coprosma quadrifida	11111	11 1++1+ +++ ++	2 1+++43222 2212+3++	Prickly Currant-bush
Clematis aristata	11111++ 1331	+11111111+ 111+11	111+++++ + + ++	Mountain Clematis
Viola hederacea	+21 11 +	11 1++1+11++1+11	+ ++++++++	Ivy-leaf Violet
Olearia lirata	+11+ 11 1	1+1 + 2+1111+23	22++ 3++ 1 121	Snow Daisy-bush
Pomaderris aspera	111143 1	211 3 +32 1 1 12	222 32 2 2+ + 3	Hazel Pomaderris
Pimelea axiflora	++11111 111	1 1+1 + 1 11	1111+1 1+ 2 1 +	Bootlace Bush
Histiopteris incisa	+ 11 121+111 1	111 ++1 211111	1+++ +	Bat's Wing Fern
Cyathea australis	4232 2+ 1231 1	31 21 122323+ 21	1+2133+ 2+	Rough Tree-fern
Blechnum wattsii	3222424145424	12 1 2 1 13 1 1	2+1221	Hard Water-fern
Polystichum proliferum	1 ++2212211122	2113131111223+31	+ 22 32 2 +	Mother Shield-fern
Dicksonia antarctica	+1 411 2121	211121 2222222+1	2+1322+ 2 +	Soft Tree-fern
Hedycarya angustifolia	112 232	+1 1++ ++++1+2+	1 3212 1	Austral Mulberry
Acacia dealbata	1 +2 23111	1132112 +22222324		Silver Wattle
Correa lawrenciana	1 +12+ 4 223	1+ 1 +2+ 21+1 1	+ 1	Mountain Correa
Polyscias sambucifolia	++ 132+323	2+21++ 1 +++ 13		Elderberry Panax
Zieria arborescens	+ 1 +1 1	21 + 1 11 222 21	2	Stinkwood
Lomatia fraseri	1	+ 2+1++ ++++ +	+	Tree Lomatia
Cassinia aculeata	+ +	1 1++ 21+212 1+		Common Cassinia
Australina pusilla ssp. muelleri	++1	11 + 1+ 1 1 +++	1 +	Shade Nettle
Sambucus gaudichaudiana	++ ++	1+++ + ++ + + 1	+ + +	White Elderberry
Eucalyptus regnans		3322 33233333	2 2223	Mountain Ash
Pittosporum bicolor	++11 + 1+	+ + + 1+++1	1 + 2	Banyalla
Viola hederacea ssp. hederacea	11+1	+11++1+11		Ivy-leaf Violet
Microsorum pustulatum	+	+ + +++	++1+1+12 +	Kangaroo Fern
Grammitis billardieri	1+1 1	+ + +	+ ++1+ +	Common Finger-fern
Lepidosperma elatius		1 1 2	12 + +133 42+	Tall Sword-sedge
Hydrocotyle hirta	+	++1 +1111++++1	+1++++ + + ++ ++	Hairy Pennywort
Goodenia ovata	11	1 +	1 1+ 21+++++11++	Hop Goodenia
Eucalyptus globulus			+2 32212 3222 222	Blue Gum
Notelaea ligustrina	1 1	+ +	21+1 ++2+2 + + 2+1	Privet Mock-olive
Atherosperma moschatum	21+			Southern Sassafras
Cassinia longifolia	+ +1			Shiny Cassinia
	EEEEEEEEEEEEE GGGGGGGGGGGGG CCCCCCCCCCCCCC 66114444444444 33667777777777 33007777888788 22247118211812 27833144112190	CCCCCECCCCCCCCCCC HHHHHGHHHHHHHHHHH CCCCCCFFFFFFFFOOO 00000601444444333 00000327999999666 01111300111111234 54568180111122150 79320063678901971	OOOOOOOOOOOOOOOOOOOO TTTTTTTTTTTTTTTTTTTT AAAAAMAAAAAAAAAAAAA 0011110000000000000 2277762222222228222 0000010000000000000 3503340346666674336 1265817661235671589O	

Mapping

In past and current practice, EVC mapping is undertaken using a combination of API, field checking (i.e. direct on-ground comparison of stands of vegetation with mapping unit descriptors, in particular lists of character species for each community as identified by the floristic analysis) and reference to mapping of related attributes (geology, landform, topography, climate and forest types). The emphasis placed on these components varies depending on the availability of data sets and their suitability for interpreting the vegetation of an area within logistic constraints. Mapping is normally prepared for presentation at 1:100 000 scale as part of the DNRE geographic information system (GIS) corporate library (EVC_100), although original API and field checking is typically conducted at a larger scale.

Table 5. Relative occurrence of life forms (and some life history types) for character species of three Cool Temperate Rainforest communities and three Wet Forest communities in Victoria.

	COOL TEMPERATE RAINFOREST			WET FOREST		
	OTWAY RANGES	EAST GIPPSLAND	CENTRAL HIGHLANDS	OTWAY RANGES	EAST GIPPSLAND	CENTRAL HIGHLANDS
sclerophyll tree	1	3	2	3	6	2
rainforest trees	2	3	2	0	1	0
understorey trees	3	5	2	5	5	4
usual epiphytes	2	1	2	1	1	1
bird dispersed	2	3	2	2	1	1
wind dispersed	1	2	0	3	3	3
basal coppice	1	2	0	1	2	2
understorey shrubs	2	2	2	5	5	10
usual epiphytes	1	2	0	1	2	2
bird dispersed	2	1	0	1	3	3
wind dispersed	0	1	2	1	1	4
ferns	19	10	7	7	7	6
treefern	2	1	1	2	2	2
tufted ground ferns	3	3	2	1	2	1
rhizomotous ground ferns	2	3	3	2	3	3
epiphytic fern	10	4	1	2	1	0
herbs	2	5	4	2	4	7
sedges	2	2	3	1	1	0
lilies	0	0	1	0	1	0
grasses	0	1	1	1	2	1
woody lianes	1	2	0	1	2	1
scramblers	1	0	0	0	0	1

Mapping, whether it be of vegetation, forest types, land systems or soils, is essentially a craft which requires the skillful and subjective blending of many inputs in an effort to interpolate the distribution of defined entities. Quantitative analysis of remotely-sensed and digitally-stored spectral data (e.g. satellite or airborne scanner imagery) is an additional input to more traditional methods, providing the capacity for rapid and detailed presentations of large areas, but equally requiring subjective setting of thresholds and interpretation of patterns in order to relate to defined entities.

RELATED ISSUES

Ecological vegetation classes and forest types

Forest types are aerial photo interpreted stand classes that are based on selected combinations of overstorey species dominance, density and height. The relationship between forest types and ecological vegetation classes is only rarely one to one; usually a many to many relationship is observed and often ecological vegetation classes are mapped independently of forest types (details outlined in Appendix D of Woodgate *et al.* 1994). There are several reasons for this:

- the combinations of attributes included in forest types have understandably been based on a resource perspective rather than an ecological perspective. This means that in many available forest type classifications, high yielding stands may have many classes (leading to a one EVC to many forest types relationship), whilst low yielding stands may have few classes (leading to the reverse);
- forest type mapping has been conducted over several decades and as a result the quality and consistency of mapping is variable from one dataset to another;
- combinations of overstorey species may or may not accurately reflect the overall response of the vegetation community of which they are a part; and
- some eucalypt species occur in a similar structural form in divergent ecological circumstances. For example, Snow Gum (Eucalyptus pauciflora) is normally associated with relatively fertile sites in sub-alpine environments above 1200m, but also occurs on the sands of lowland plains at sea level in the EVC Coastal Grassy Forest.

Forest types and EVCs are both valuable inputs to planning processes and, notwithstanding their lack of a straightforward interrelationship, can also be mutually beneficial. Some forest type boundaries are highly suitable for EVC boundaries and are used to assist mapping. Some EVC boundaries have been used to increase the discrimination of site quality in broadly-defined forest types.

Comparisons with systematics

An analogy can be drawn between the vegetation typology being developed and the familiar hierarchy of species taxonomy. Whilst recognising that the vegetation typology is a construct for the purposes at hand, and that vegetation may not be inherently hierarchic in the manner of systematics, the analogy is useful for highlighting the ways in which different types of information and value judgements can apply at different levels in the two hierarchies.

Table 6: Comparison of systematics and vegetation typology.

	Taxonomy	Typology	Common Concepts
Level	*Sub-species or Variety*	*Floristic Sub-community*	
Characteristics	- differences may not always be obvious e.g. plant may need to be flowering or have reached maturity for difference to be displayed - differences often represent a continuum and differentiation between specimens growing in close proximity may be difficult	- differences usually subtle or may be minor steps along a more or less continuous gradient - differences may be temporal in response to site history and the distinction between to sub-communities may be difficult to detect in the field - differences based entirely on unweighted floristics	- differences subtle or simple attributes may change from one form to another quite readily, others may not always be readily observable
Level	*Species*	*Floristic Community*	
Characteristics	- definition implies interbreeding gene pool status but this is usually only inferred from morphological similarities. - usually there are some readily observable differences	- definition implies a dependency on a suite of environmental attributes but this is usually only inferred from consistent co-occurrence - boundaries usually readily observable - differences typically perennial or at least maintained over long periods - differences based on floristics, including weighting for ecologically important species	- typically based on quantitative analysis of the full range of the selected attributes - based on important holistic concepts (evolutionary and ecological) which pragmatism dictates can only be applied in simple terms - provide information at the most appropriate level for biodiversity considerations
Level	*Genus*	*EVC*	
Characteristics	- focus on attributes which are considered to represent more fundamental (or primitive) differences e.g. floral structure, sexual reproduction mechanisms - some indirect attributes are considered e.g. biogeography and apparent evolutionary history of similar taxa	- focus is on biophysical attributes which are considered to relate closely to the most influential ecological processes acting at the landscape scale for a particular site	- a broader range of attributes, including direct and indirect ones, are used to support distinctions relies on expert opinion as to which attributes are most fundamental

The position of particular entities within these hierarchies changes with time as new information becomes available and new relationships are proposed and substantiated.

Heterogeneity within ecological vegetation classes

The floristic composition of an ecological vegetation class can be fairly conservative having no more than a floristic sub-community level of variation at a regional scale (e.g. Wet Forest). However this may not be the case where a strong biogeographic gradient is operating along a floristic and geographic continuum, as for example, is the case in East Gippsland with Lowland Forest. Within East Gippsland, Lowland Forest is widespread below 400m elevation from Lakes Entrance east to, and beyond the New South Wales border. Table 1 illustrates the composition of two floristic communities of Lowland Forest. Lowland Forest ("EG 1") occurs over a wide area east of Orbost to just west of Mallacoota whilst Lowland Forest ("EG 2") occurs west of Orbost to Nowa Nowa.

A comparable floristic dissimilarity occurs where an ecological vegetation class remains isolated for long periods in different areas of the state. In this situation the biogeographic gradients are more disjunct and are spread over a greater geographical distance than is the case with the first example, Lowland Forest. This second case is exemplified by the distribution and the disparate floristic composition of Cool Temperate Rainforest (Table 3) and its neighbouring ecological vegetation class Wet Forest, which have been effectively isolated within different geographic regions of Victoria since the end of the last Ice Age 10-15 000 yrs BP.

The EVC Cool Temperate Rainforest is considered to occur in the appropriate climatic refuges of five of the state's natural regions sensu Conn (1993): Otway Range, Eastern Highlands, Gippsland Highlands, Wilsons Promontory and East Gippsland. Although there are floristic dissimilarities across this EVC which support the identification of three floristic communities, there remains a demonstrable similarity in life-form composition and life history profile (Table 5). Conversely, the differences between Cool Temperate Rainforest and its neighbouring Wet Forest floristic community can also be illustrated by a comparison of life-form/life history information (Table 5).

Scale

In Victoria, ecological vegetation classes are mapped at a variety of scales (1:25 000, 1:40 000 and 1:100 000, 1:250 000), depending on the initial purpose of the exercise and the logistic constraints involved. A scale of 1:100 000 has been chosen for the development of a Statewide coverage since this provides information that is usable both for strategic planning at the regional level and operational planning at the local scale. It has also proved feasible to resource work at this scale within the timelines of regional planning activities. The RFA process is retaining consistency with land management planning at the regional level by utilising ecological vegetation class mapping at a presentation scale of 1:100 000.

Ecological vegetation classes and biodiversity conservation
Ecological vegetation classes are not the only units which could be used for determining the adequacy of biodiversity conservation, nor are they necessarily the best units for this assessment. However, they are believed to be the most appropriate available units for the task at the landscape scale. Although EVCs are based on vascular plant floristics, they may provide a useful surrogate for other values, such as particular species or groups of fauna or non-vascular plants, but there has not yet been any quantitative testing of this possibility.

For vascular plants, floristic communities are clearly the most appropriate level of the vegetation typology for conservation purposes, with nominations under the *Flora and Fauna Guarantee Act* 1988 usually assessed on this basis. Although EVCs at the Statewide level typically each include a number of floristic communities, at the local scale the relationship is usually one-to-one and therefore EVC mapping is an adequate framework for planning decisions.

However, at the regional scale, mapping of floristic communities within EVCs has not generally been completed because it is a more difficult and time-consuming task than distinguishing between map units which are both different communities and different EVCs. Therefore, for planning at this scale (e.g. Forest Management Areas) an additional form of discrimination is required where extensive ecological vegetation classes are known to be floristically heterogeneous. For East Gippsland this was achieved by using geographic subunits to ensure a representative coverage of these EVCs in the retained habitat network. In future this approach could be refined by further analysis of the floristic data for such EVCs.

CONCLUSIONS

Achievements
The approach to vegetation classification outlined in this document has:

- provided a new unifying level in the vegetation typology that links vegetation units from different biogeographic regions via attributes such as floristics, life-form, reproductive strategy and physical environment;
- provided a framework that, in the absence of a fully annotated data base, has allowed some consistent characterisation of each ecological vegetation class across the State;
- enabled the provision of more discriminating advice on vegetation management at the landsacpe scale to be given to land managers and management agencies;
- facilitated the task of compiling of a Statewide vegetation typology in Victoria which aims to provide a benchmark description of the vegetation of the state; and
- reduced the likelihood of inappropriately defined or poorly researched nominations of floristic communities being listed under the *Flora and Fauna Guarantee Act* 1988.

Future development and refinement

The classification of variation in vegetation, and particularly the erection of boundaries between vegetation types which is required for mapping, inherently include a number of value judgements and assumptions. Whilst elements of this process can be quantitative, repeatable and explicit (and there are always options for improvement as discussed) there remains a critical need to validate the results of the process. This is not to suggest that the results are believed to be invalid, rather that there is value in quantifying the degree to which the results meet certain objectives. This validation may relate to the vegetation classification process (e.g. Did the sampling strategy adequately capture the heterogeneity of the study area?), to the mapping process (e.g. How reliably do mapped polygons relate to EVCs on the ground?), and to the use of the product of this process as a surrogate (e.g. To what extent do EVCs adequately define habitat for a particular group of species?). Validation of this type will require the commitment of resources to properly designed double-sampling procedures and analyses.

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ATTACHMENT 1 - Examples of ecological vegetation class nomenclature from an ectract of the Statewide Vegetation Typology (DNRE (in prep)).

Names in **bold** are those currently accepted by the Census, those in "quotation marks" are mosaics (a mapping unit), those in *italics* are floristic communities.

- **Alluvial Plains Shrubland** (Parkes *et al.*)
- **Alluvial Terraces Herb-rich Woodland** (Muir *et al.* 1995)
- **"Alluvial Terraces Herb-rich Woodland/Creekline Grassy Woodland Mosaic"**
- **"Alluvial Terraces Herb-rich Woodland/Heathy Dry Forest Mosaic"**
- **Banksia Woodland**
- **Belah Woodland** (Parkes *et al.*)
- **Big Mallee** (this census) = Big Mallee Yellow Gum Woodland (Parkes *et al.*)
- **Black Box Chenopod Woodland** (Parkes *et al.*)
- **Box-Ironbark Forest** Muir *et al.* (in press) = (in part) Grey Box (*Eucalyptus microcarpa* - Red Ironbark (*E. sideroxylon*) dry sclerophyll forest Communities 1, 2, 3 and 4 McMahon and Carr (1988); (in part) Grey Box Yellow Gum (*Eucalyptus microcarpa* - *Eucalyptus leucoxylon*) Dry Sclerophyll Forest Carr *et al.* (1989b); (in part) *Eucalyptus polyanthemos* (Red Box) - *E. macrorhyncha* (Red Stringybark) - *E. microcarpa* (Grey Box) Dry Sclerophyll Forest Todd and McMahon (1990)

  Box-Ironbark Forest (Northern Goldfields) Muir *et al.* (1995) = Box Ironbark Forest Walsh (1987)

  Box-Ironbark Forest (Western Goldfields) Muir *et al.* (1995)

  Box-Ironbark Forest (North-eastern Victoria) Muir *et al.* (1995)

  Box-Ironbark Forest (Yarra Valley) Muir *et al.* (1995)
- **Box Woodland** (LCC 1991)
- **Brackish Sedgeland** (Woodgate *et al.* 1994)
- **Broombush Mallee** (this census) = in part Sandstone-rise Broombush Mallee (Parkes *et al.*)

  Broombush Mallee (Goldfields) Muir *et al.* (1995)
- Buloke Herb-rich Woodland (this census) = (in part) Grey Box-Buloke Grassy Woodland Community 4 (Bedgood and McMahon 1992); Yellow Gum Grassy Woodland Sub-community 5.2 (Bedgood and McMahon (1992)
- **Chenopod Mallee** (Parkes *et al.*)
- **Clay Heathland**
- **Closed Heathland** (Duncan *et al.*)
- **Coast Banksia Woodland**
- Coastal Sclerophyll Forest Parkes *et al.* (1983) = (in part) **Limestone Box Forest** (Woodgate *et al.* 1994); (in part)

ATTACHMENT 2 Physical attributes used in East Gippsland to determine the distribution of ecological vegetation classes mapped by the Department of Conservation and Natural Resources in the East Gippsland Regional Forest Area. (↑ = relatively high levels; ↓ = relatively low levels; n = average)

Ecological vegetation class	Discriminating attributes	Discriminating attribute features	Non-discriminating attributes
Coastal Dune Scrub Complex	Geology/soils/ exposure/soil water relations/landform/ climate/effective rainfall	Aeolian sands/ soils ↑Ca, ↑Fe, ↓humus/ ↑exposure to salt and wind/ droughty soils/ primary dunes/ maritime climate/ low effective rainfall	salinity/aspect/slope/ elevation/rainfall
Coast Banksia Woodland	Geology/soils/ exposure/soil water relations/landform/ climate/effective rainfall	Aeolian sands/ soils ~Ca, ~Fe, ~humus/ droughty soils/ ~exposure to salt and wind/ secondary dunes/ maritime climate/ low effective rainfall	salinity/aspect/slope/ elevation/rainfall
Coastal Grassy Forest	Geology/soils/ exposure/soil water relations/landform/ rainfall/effective rainfall	Aeolian sands/ soils ↓Ca, ~Fe, ~humus/ ↓exposure to salt and wind/ well drained but damp soils / tertiary dunes or sand sheets/ rainfall <800mm/ moderate effective rainfall	salinity/aspect/slope/ elevation/climate
Coastal Vine-rich Forest	Geology/soils/ exposure/soil water relations/landform/ aspect/slope/ rainfall/climate/ effective rainfall	Granites, aeolian sands/ colluvial or aeolian sands ↓Ca, ~Fe, ~humus/ moderate to low exposure to fire/ moist soils/ coastal hills and minor gullies/ southern aspects/ gentle slope/ 1000-1200mm rainfall/ maritime climate/ high effective rainfall	salinity/elevation
Coastal Sand Heathland	Geology/soils/ exposure/soil water relations/landform/ climate/ effective rainfall	Aeolian sands/ ~Ca, ~Fe, ↓humus/ ~ to ↑exposure to salt and wind/ droughty soils/ dunes/ maritime climate/ low effective rainfall	salinity/aspect/slope/ elevation
Sand Heathland	Geology/soils/ soil water relations/landform/ rainfall/ effective rainfall	Aeolian sands, granitic sands/ ↓Ca, ↓Fe, ↓humus/ droughty soils/ sandy slopes dunes, or sand sheets/ rainfall <750mm/ low effective rainfall	exposure/salinity/ aspect/slope/elevation/ climate
Clay Heathland	Geology/soils/ exposure/soil water relations/landform/ aspect/slope /elevation/rainfall	Outwash clays/ white duplex soils over yellow subsoils/ ↑exposure to fire/ soils water-logged in winter, dry in summer/ shallow depressions or slopes/ northern or western aspects if on slopes/ gentle/ <100m/ <800mm	exposure/salinity/ climate/effective rainfall
Wet Heathland	Geology/soils/ exposure/soil water relations/landform/ slope/elevation/rainfall/ climate/effective rainfall	Aeolian or outwash sands/peaty sands/ ↑exposure to fire/ water-logged soils most of the year, damp in summer/ depressions on plains or slopes near drainage lines/ gentle slopes/ <150m/ 800-1100mm/ maritime/ high	salinity/aspect

Ecological vegetation class	Discriminating attributes	Discriminating attribute features	Non-discriminating attributes
Coastal Saltmarsh	Geology/soils/ exposure/soil water relations/salinity/ landform/slope/ elevation	Lacustrine deposits/ sandy peats, organic muds/ ↑exposure to wind and salt/ ↓exposure to fire/ soils water-logged/ ↑ salinity through daily inundation by tides/ estuarine flats/ negligible slope/ sea level	aspect/rainfall/climate/ effective rainfall
Estuarine Wetland	Geology/soils/ exposure/soil water relations/salinity/ landform/slope/ elevation	Lacustrine deposits/ sandy peats, organic muds/ ~ exposure to wind and salt/ soils water-logged/ variable salinity (↑ to ↓) through prolonged and periodic flooding/ estuarine flats/ negligible slope/ sea level	aspect/rainfall/climate/ effective rainfall
Coastal Lagoon Wetland	Geology/soils/soil water relations/salinity/ landform/climate/ effective rainfall	Colluviums/ sandy peats and muds/ soil at field capacity/ usually flooded by freshwater/ depressions on near-coastal plains/ maritime/ ↑effective rainfall	exposure/aspect/ slope /elevation/rainfall
Wet Swale Herbland	Geology/soils/ exposure/soil water relations/salinity/ landform/ climate/ effective rainfall	Alluvium-aeolian mixtures/ peaty sands/ ↑wind exposure ~salt exposure/ soils at field capacity/ freshwater to mildly brackish/ swale/ maritime/ ↑effective rainfall	aspect/slope/ elevation/climate
Brackish Sedgeland	Geology/soils/ exposure/soil water relations/salinity/ landform/ elevation/climate/ effective rainfall	Alluvium-aeolian mixtures/ peaty sands/ ↑wind exposure ~salt exposure/ soils generally at field capacity only over winter, sometimes flooded for long periods with water backup from lake closure/ freshwater to mildly brackish/ swale/ sea level/ maritime/ ↑effective rainfall	aspect/slope/rainfall
Banksia Woodland	Geology/soils/ exposure/soil water relations/ exposure/ landform/climate/ effective rainfall	Outwash and aeolian sands/ soils ↓Ca, ↓Fe, ↑humus/ well drained soils/ ↓exposure to salt and wind/ tertiary dunes and sand sheets/ maritime climate/ moderate effective rainfall	aspect/slope/ elevation/rainfall
Limestone Box Forest	Geology/soils/ landform/aspect/ rainfall/climate/ effective rainfall	Mostly limestone occasionally silty outwash/ terra rossas or silt loams/ gullies and nearby slopes/ all aspects except south/ 760-900mm/ maritime/ moderate	soils/soil water relations/salinity/ slope /elevation
Lowland Forest	soils/soil water relations/landform/ slope/elevation/rainfall/ climate/effective rainfall	Clays, sandy clays and clayey gravels/ well drained/ coastal outwash plains and embedded or hinterland hills/ gentle slopes/ <400m/ >750mm/ maritime/ moderate to high effective rainfall	Geology/exposure/ salinity/aspect

Ecological vegetation class	Discriminating attributes	Discriminating attribute features	Non-discriminating attributes
Riparian Scrub Complex	Geology/soils/soil water relations/ salinity/landform/ aspect/ slope/ elevation/rainfall/ climate/ effective rainfall	Alluviums/ peaty sands/ water-logged soils year-round/ freshwater/ lowland streams of low gradient/ <150m/ 800-1000mm rainfall	exposure
Riparian Forest	Geology/soils/soil water relations/ landform/ slope/ elevation/effective rainfall	Alluviums/ silts loams and sands/occasional inundation with freshwater/ alluvial terraces of permanent streams/ gentle slopes/<800m/ ↑effective rainfall	exposure/soil water relations/salinity/ rainfall/climate
Riparian Shrubland	soils/exposure/soil water relations/ landform/ slope/ elevation/effective rainfall	Rock bars, cobbles, sands/ frequent and violent inundation with freshwater exposed to severe flooding/ river courses of major streams/ moderate slopes/<800m/ ~ ↓effective rainfall	Geology/salinity/ soil water relations/ rainfall/climate
Heathy Dry Forest	Geology/soils/ exposure/soil water relations/landform/ aspect/slope /elevation/rainfall/ climate/effective rainfall	Granites/ sandy loams/ ↑fire exposure and insolation/ well drained/ foothills/ north and west/ moderate to steep slope/ 200-900m/ 750-1000mm/ warm dry continental/ ↓effective rainfall	salinity
Shrubby Dry Forest	Soils/exposure/soil water relations/ landform/aspect/slope /elevation/rainfall/ climate/effective rainfall	Skeletal sandy clays/ ↑fire exposure and insolation/ well drained/ foothills/ north and west/ moderate to steep slope/ 200-900m/ 750-1000mm/ warm dry continental/ ↓effective rainfall	Geology/salinity
Grassy Dry Forest	Geology/soils/ exposure/soil water relations/landform/ slope /elevation/ rainfall/climate/ effective rainfall	Granites/ sandy clay loams/ ~fire exposure and insolation/ well drained/ foothills slopes and broad ridges/ gentle to moderate / 200-900m/ <800mm/ warm dry continental/ ↓effective rainfall	Salinity/aspect
Valley Grassy Forest (formerly Herb-rich Forest)	Geology/soils/ exposure/soil water relations/landform/ slope /elevation/ rainfall/climate/ effective rainfall	Granodiorite, limestone/ clay loams/ ~fire exposure ↓insolation/ well drained/ foothills slopes and valley floors/ gentle/ 250-400m/ <760-900mm/ warm dry continental/ ~effective rainfall	salinity/aspect
Foothill Box Ironbark Forest	Geology/soils/ exposure/soil water relations/landform/ aspect/slope/ elevation/rainfall/ climate/effective rainfall	Sedimentary/ skeletal sandy clay loam/ ~exposure to fire/ well drained/ foothills/ west and north/ moderate slope/ 800-900m/ 700-800mm/ warm dry continental/ ~effective rainfall	salinity

Ecological vegetation class	Discriminating attributes	Discriminating attribute features	Non-discriminating attributes
Limestone Grassy Woodland	Geology/soils/ exposure/soil water relations/landform/ aspect/rainfall/ climate/effective rainfall	Limestone/ terra rossas/ ↑insolation/ well drained/ karst hills and slopes/ north and west/ <760mm/ warm dry continental/ ↓effective rainfall	salinity/slope /elevation
Rainshadow Woodland	Geology/soils/ exposure/soil water relations/landform/ slope/elevation/rainfall/ climate/effective rainfall	Granodiorite/ sandy clay loams/ ~fire exposure ↑insolation/ well drained/ foothills slopes and valley floors/ gentle to moderate/ 100-600m/ <760mm/ warm very dry continental/ ↓effective rainfall	salinity/aspect
Rocky Outcrop Scrub	Soils/exposure/soil water relations/ landform/aspect/ slope/elevation/rainfall/ climate/effective rainfall	Brown earths often skeletal/ ↑insolation, ~ to ↓fire/ well drained/ steep foothills/ north west/ very steep/ 650-900mm/ hot very dry continental/ ↓effective rainfall	Geology/salinity/ elevation
Rocky Outcrop Shrubland	Soils/exposure/soil water relations/ landform/aspect/slope/ rainfall/climate/ effective rainfall	Skeletal soils/ ↑insolation, ~ to fire/ well drained soils/ foothill rocky ridges and slopes/ north and west aspects/ steep slopes/ 600-700mm/ hot dry continental/ ↓effective rainfall	Geology/soils/ exposure/soil water relations/salinity/ landform/aspect/ slope/elevation/rainfall/ climate/effective rainfall
Damp Forest	soils/exposure/l andform/aspect/ rainfall/climate/ effective rainfall	Moderately well developed clay loams/ moist soil profiles year round/ ~insolation, ~ exposure to fire, ~insolation/ foothills/ southern or eastern aspects until fog drip becomes significant and then aspect is not as important/ 1000-1200mm/ warm humid continental/ moderate to high	Geology/soil water relations/ salinity/slope
Wet Forest	soils/exposure/soil water relations/ landform/aspect/ elevation/rainfall/ climate/effective rainfall	Deep kraznosems/ wet soil profiles year round/ ~ to ↓exposure to fire, ~ to ↓insolation/ foothills and montane plateaus/ southern or eastern aspects until fog drip becomes significant and then aspect is not as important/ 800-1100m/ 1200-2000mm/ cool wet humid maritime/ high	Geology/salinity/slope
Cool Temperate Rainforest	Soils/exposure/soil water relations/ landform/aspect/ elevation/rainfall/ climate/effective rainfall	Kraznosems with ↑humus/ wet soil profiles year round/ ↓exposure to fire, ↓insolation/ foothills and montane plateaus/ southern or eastern aspects until fog drip becomes significant and then aspect is not as important/ cool to cold wet humid maritime/ very high	Geology/salinity/slope

Ecological vegetation class	Discriminating attributes	Discriminating attribute features	Non-discriminating attributes
Warm Temperate Rainforest	Soils/exposure/soil water relations/ landform/aspect/ elevation/rainfall/ climate/effective rainfall	Clay loams with ↑humus/ ↓exposure to fire, ~ ↓insolation/ damp soil profiles year round/ gullies of coastal plains, river valleys and low foothills/ southern or eastern aspects/ 600-1200m/ 1200-2000mm/ warm humid maritime/ moderate to high	Geology/salinity/slope
Cool/Warm Temperate Rainforest Overlap	Soils/exposure/soil water relations/ landform/aspect/ elevation /climate/ effective rainfall	Clay loams with ↑humus/ damp soil profiles year round/ ↓exposure to fire, ~ ↓insolation/ gullies foothills/ southern or eastern aspects/ 129-870m/ warm to cool humid maritime/ moderate to high	Geology/salinity/slope/ rainfall
Dry Rainforest	Soils/exposure/soil water relations/ landform/aspect/ slope/elevation/rainfall/ climate/effective rainfall	Boulders and skeletal loams with ↑humus/ dry soil profiles year round/ ↓exposure to fire, ↑insolation/ soils droughty at some time of the year/ cliffs and screes of low foothills/ northern or western aspects/ generally steep slopes/ 750-900mm/ <0-120m/ warm humid continental/ low	Geology/salinity
Tableland Damp Forest	Soils/exposure/soil water relations/ landform/slope/ elevation/rainfall/ climate/effective rainfall	Moderately well developed clay loams/ ~ exposure to fire, ~insolation/ moist soil profiles year round/ montane tablelands/ gentle/ 1100-1300m/ 850-1200mm/ seasonal (cool to cold humid maritime in autumn, winter and spring continental (with occasional snow), warm continental in summer) fog drip becomes significant in autumn, winter and spring but not in summer/ moderate to high	Geology/salinity/aspect
Montane Dry Woodland	Soils/exposure/ landform/elevation/ climate/effective rainfall	Moderately well developed sandy clay loams/ slopes, ridges, and plateaus/ 1000-1200m/ cold dry continental (with snow)/ low to moderate	Geology/ soil water relations/salinity/ aspect/slope/rainfall
Montane Grassy Woodland	Geology/soils/ landform/elevation/ climate/effective rainfall	Basalts, granodiorites/ moderately well developed fertile clay loams/ slopes, ridges, and plateaus/ 900-1200m/ cold dry continental (with snow)/ mod.e	Geology/exposure/ soil water relations/ salinity/elevation/ climate/effective rainfall
Montane Damp Forest	Soils/exposure/ landform/elevation/ climate/effective rainfall	Moderately well developed sandy clay loams/ ~isolation/ slopes and plateaus/ southern and eastern/ 1000-1200m/ cold damp continental (with snow)/ moderate	Geology/exposure/soil water relations/ salinity/aspect

Ecological vegetation class	Discriminating attributes	Discriminating attribute features	Non-discriminating attributes
Montane Wet Forest	Soils/exposure/ landform/aspect/ elevation/rainfall/ climate/effective rainfall	Well developed clay loams/ ↓exposure to fire, ~exposure to fire/ slopes and plateaus/ southern and eastern/ 1000-1200m/ cold wet continental (with snow)/ high	Geology/soil water relations/salinity/ aspect
Montane Riparian Woodland	Geology/soils/ exposure/soil water relations/landform/ slope /elevation/ climate/effective rainfall	Alluviums/ silt/ sheltered creek valleys/ damp soils from streams/ alluvial flats/ gentle slopes/ 900-1200m/ cold dry continental (with snow)/ moderate to high	Salinity/aspect/rainfall
Montane Riparian Thicket	Geology/soils/ exposure/soil water relations/landform/ slope /elevation/ climate/effective rainfall	Alluviums/peaty sands and silts/ sheltered creek valleys/ wet soils from streams/ alluvial flats/ gentle slopes/ 1000-1200m/ cold wet continental (with snow)/ high	Salinity/aspect/rainfall
Sub-alpine Shrubland	Geology/soils/ soil water relations/ landform/elevation/ climate/effective rainfall	Tilted sedimentary/ skeletal sandy clays/ dry soils/ broad ridge/ 1200-1400m/ cold dry continental (with snow)/ low	Exposure/salinity/ aspect/slope/rainfall
Sub-alpine Woodland	Soils/landform/ elevation/climate/ effective rainfall	Moderately well developed clay loams with ~ humus/ slopes, ridges, and plateaus/ 1200-1400m/ cold dry continental (with frequent snow)/ moderate	Geology/exposure/ soil water relations/ salinity/aspect/slope/ rainfall
Treeless Sub-alpine Complex	Soils/exposure/soil water relations/ slope/elevation/ climate/effective rainfall	Peats and sands/ exposure to wind, frosts and snow/ wet soils/ drainage lines/ gentle slopes/ 900-1400m/ cold dry continental (with frequent snow)/ moderate	Geology/salinity/ landform/aspect/ rainfall

ECOLOGICAL VEGETATION CLASSES
PEER REVIEW REPORT
5 JUNE 1996

Background
Ecological Vegetation Classes (EVCs) are derived from underlying large scale forest type and floristic community mapping with floristic, structural, and environmental attributes being used to define individual EVCs.

The process of deriving EVCs had not previously been formally documented and critically appraised, although Woodgate *et al.* (1994) provided an overview of the methodology. The Department of Natural Resources and Environment (NRE), as part of the East Gippsland Comprehensive Regional Assessment, has prepared a full description of the methodology used to derive EVCs.

This paper was peer reviewed on 5th June 1996, and modified in response to comments received. The final paper is included in this Appendix.

The Peer Group
A group of experts was invited to peer review the EVC methodology report, as described in a draft report prepared by NRE. Members of the group were:

Dr Mark Burgman	University of Melbourne, Victoria
John Benson	National Herbarium, Sydney, New South Wales
Sandy Kinnear	Department of Housing and Urban Development, South Australia.
Prof Jamie Kirkpatrick	University of Tasmania, Tasmania
Dr Bob Parsons	La Trobe University, Victoria

Adrian Moorrees, David Parkes and Bill Peel of the Department of Natural Resources and Environment (NRE), Victoria were present at the review to explain the EVC methodology and answer questions. Brendan Edgar and John Neldner of the Australian Nature Conservation Agency, and Harry Abrahams of the Australian Heritage Commission were present at the review as observers.

Objectives
To facilitate discussion by the peer group, a number of questions were presented for consideration These were:

- Do you understand the process to derive and define Ecological Vegetation Classes?
- Are these processes ecologically sound and valid?
- Is the relationship of EVCs to environmental attributes, floristic vegetation communities, floristic sub-communities and forest types understood and ecologically sound?

- Is the homogeneity within EVCs sufficient for biodiversity assessments of forest communities?
- Are Ecological Vegetation Classes suitable for a 1:100 000 scale vegetation map for the CRA forest biodiversity assessment of forest communities ?

Summary of Outcomes

- The EVC concept was developed as a regional planning tool that can be applied consistently across the State to raise the awareness of land managers and the public regarding biodiversity conservation and ecological management, and ultimately to produce better land management practice. The identification and mapping of EVCs involves the combination of floristic, life form and reproductive strategy profiles, and relating these to particular environmental site attributes, including aspect, elevation, gradient, geology, soils, landform and rainfall. EVCs are derived from a generally consistent methodology and provide an important Statewide level of vegetation classification and the basis of an on-going mapping program;
- The floristic analysis used to generate EVCs was generally understood. However the step of linking or amalgamating floristic groups into EVCs was less well understood and imprecise, as different environmental attributes were used in defining different EVCs. The attributes (rules) used to group floristic units into EVCs need to be clearly stated for each EVC;
- Mapping of floristic communities (a more detailed level than EVCs) would provide a higher level of discrimination for local conservation planning and land management. This level of mapping will not be completed for many years, although this is not a major impediment to planning at the regional scale since the majority of EVCs comprise a single floristic community. In these cases the EVC is an appropriate basis for assessing floristic biodiversity conservation. However, some EVCs appear to be more heterogeneous, for example some EVCs combine several dominant tree species with different fire sensitivities and regeneration mechanisms. Within East Gippsland, four extensive ecological vegetation classes were considered to contain a significant amount of heterogeneity, particularly if dominant structural form and floristic composition only are used to define EVCs (Damp Forest, Wet Forest, Lowland Forest and Shrubby Dry Forest).
- It was considered that the issue of heterogeneity within the four extensive EVCs in East Gippsland should be further examined. This issue was recognised in the development of the East Gippsland Forest Management Area Plan whereby a geographic sub-unit analysis, as a surrogate, was undertaken in an attempt to ensure that the heterogeneity and range of EVCs was represented in the reserve system.
- The group of experts suggested additional analyses that could be undertaken to address the heterogeneity issue for the four large EVCs. These included the use of forest type mapping, and/or the construction of floristic communities, followed by an assessment of their occurrence in the reserve system. It was noted that if this work were to be conducted it could

not be completed in time for inclusion in the Environment and Heritage assessment report for East Gippsland.

- It was proposed that a validation project be designed for EVC mapping. (It was noted that a validation project for EVC old growth mapping was being considered). In future, validation components could be included as standard in vegetation survey and mapping projects.
- It was proposed that an investigation be conducted as to whether an appropriate heterogeneity analysis could be used to compare the mapping outputs in different Regional Forest Agreement regions across States.

Discussion

The EVC concept

1. The EVC concept was developed as a regional planning tool that can be applied consistently across the State, and should be judged mainly on its effectiveness in conservation planning - raising the awareness of land managers and the public regarding biodiversity conservation and ecological management, ultimately to produce better land management practice. The identification and mapping of EVCs involves the combination of floristic, life form and reproductive strategy profiles, and relating these to particular environmental site attributes, including aspect, elevation, gradient, geology, soils, landform and rainfall;
2. EVCs are derived from a generally consistent methodology and provide an important Statewide level of vegetation classification and the basis of an on-going mapping program. Mapping of floristic communities is the ideal level of discrimination for detailed local conservation planning and land management. However, because of the time and data required, it will not be completed for many years. At regional scales, most EVCs will exist as a single floristic community, and in these cases EVC mapping provides an adequate level of discrimination. For the EVCs where this is not the case, additional strategies for discrimination for planning purposes will be required.

Validity of the methods used

3. The best test of the validity of the EVC approach was seen as being a deliberate validation exercise, involving random selection and field validation of an independent sample of sites following vegetation survey, analysis and mapping.
4. It was recognised that subjective judgement is important in the EVC methodology, as well as for other vegetation classifications, although scientific analysis generally aims to reduce subjectivity. The step of linking or amalgamating floristic groups into EVCs, which relies on subjective assessments, made it difficult for participants to judge the consistency and validity of the overall approach. The group sought a description of the process used and the specific attributes applied to individual EVCs to clarify these issues.

Appropriateness of EVCs as units for biodiversity conservation

5. It was generally agreed that the participants would benefit from a better understanding of the relationships between EVCs and environmental parameters. However:
   - most of the EVCs in East Gippsland seemed appropriate as the basis for assessing biodiversity conservation,
   - some were considered to be more heterogeneous than others,
   - if the heterogeneity issue could be addressed, EVCs were a good unit, given their floristic basis.
6. The classification which resulted from the EVC approach was seen as being too broad in some cases and needing additional discrimination - e.g. single units combining dominants with different fire sensitivities.
7. The main issue regarding heterogeneity in the East Gippsland Regional Forest Agreement region is with extensive ecological vegetation classes - Damp Forest, Wet Forest, Lowland Forest and Shrubby Dry Forest. This issue was recognised in the proposed East Gippsland Forest Management Plan, in which representative protection of this variation was considered by allocating reserved habitat across a framework of geographic sub-units for all EVCs.
8. Additional analyses that could be undertaken to address the heterogeneity issue for the four large EVCs included the use of forest type mapping, and/or the construction of floristic communities, followed by an assessment of their occurrence in the reserve system.
9. It was agreed that it would be valuable to consider undertaking a comparative assessment of the levels of heterogeneity within vegetation units used in various States for Comprehensive Regional Assessments.

Appropriateness of scale of mapping

10. Participants felt that vegetation mapping should aim to represent areas that act as the most effective surrogates for other elements of biodiversity, to maximise uniformity within vegetation types, and to map boundaries between types that can be identified in the field.
11. The scale of 1:100,000 used for EVCs was seen as an acceptable scale for this mapping given the average size of Regional Forest Agreement regions.

Appropriateness of mapping method

12. It was generally agreed that vegetation mapping should be based on a combination of survey, analysis, aerial photo interpretation (or other remote sensed information) and ground truthing.
13. It was proposed that formal validation procedures be used to verify the results.